

What is claimed is:

1. A method for preparing a fatty acid ester comprising reacting fats and oils with a monohydric alcohol under conditions where the monohydric alcohol is in a supercritical state, wherein  
5 a reaction mixture containing unreacted reactants and/or intermediate products is recycled to the reactor.
2. The method according to claim 1 which further comprises a step of removing the fatty acid ester from the reaction mixture prior to being supplied to the reactor.
- 10 3. The method according to claim 2, which comprises the steps of:
  - (A) supplying fats and oils and a monohydric alcohol in a reactor;
  - (B) reacting the fats and oils with the monohydric alcohol  
15 under conditions where the monohydric alcohol is in the supercritical state to obtain a reaction mixture;
  - (C) removing the monohydric alcohol from the reaction mixture obtained in step (B) to obtain an alcohol-free reaction mixture;
  - 20 (D) separating the alcohol-free reaction mixture obtained in step (c) to a light liquid containing the fatty acid esters and a heavy liquid containing glycerol;
  - (E) removing the fatty acid esters from the light liquid obtained in step (D) to obtain an unreacted material liquid  
25 containing the unreacted reactants and/or intermediate products; and
  - (F) supplying the unreacted material liquid obtained in step (E) to the reactor.

4. The method according to claim 2, which comprises the steps of:

(A) supplying fats and oils and a monohydric alcohol in a reactor;

5 (B) reacting the fats and oils with the monohydric alcohol under conditions where the monohydric alcohol is in the supercritical state to obtain a reaction mixture;

(G) separating the reaction mixture obtained in step (B) to a light liquid containing the fatty acid esters and a heavy  
10 liquid containing glycerol;

(H) removing the monohydric alcohol from the light liquid obtained in the step (G) to obtain an alcohol-free light liquid;

(I) removing the fatty acid esters from the alcohol-free light liquid obtained in step (H) to obtain an unreacted material  
15 liquid containing the unreacted reactants and/or intermediate products; and

(J) supplying the unreacted material liquid obtained in step (I) to the reactor.

5. The method according to any one of claims 1 to 4, wherein  
20 said monohydric alcohol is an alcohol of the formula:



wherein R is a hydrocarbyl group having 1 to 10 carbon atoms, or a hydrocarbyloxyl group-substituted hydrocarbyl group having 2 to 10 carbon atoms in total.

25 6. An apparatus for preparing a fatty acid ester comprising reacting fats and oils with a monohydric alcohol in a reactor under conditions where the monohydric alcohol is in a supercritical state, wherein the apparatus has a mechanism for recycling a

reaction mixture containing unreacted reactants and/or intermediate products to a reactor.

7. The apparatus according to claim 6, which further comprises a separation means to isolate the fatty acid ester from  
5 the reaction mixture.

8. The apparatus according to claim 7, which comprises  
(a) a means for supplying fats and oils and a monohydric alcohol in a reactor;

(b) a reactor in which the fats and oils are reacted with  
10 the monohydric alcohol under conditions where the monohydric alcohol is in the supercritical state to obtain a reaction mixture;

(c) a separation means for removing the monohydric alcohol from the reaction mixture obtained in the reactor (b) to obtain an alcohol-free reaction mixture;

15 (d) a separation means for separating the alcohol-free reaction mixture obtained with the separation means (c) to a light liquid containing the fatty acid esters and a heavy liquid containing glycerol;

(e) a separation means for removing the fatty acid esters  
20 from the light liquid obtained with the separation means (d) to obtain an unreacted material liquid containing the unreacted reactants and/or intermediate products; and

(f) a means for supplying the unreacted material liquid obtained with the separation means (e) to the reactor (b).

25 9. The apparatus according to claim 7, which comprises

(a) a means for supplying fats and oils and a monohydric alcohol in a reactor;

(b) a reactor in which the fats and oils are reacted with

the monohydric alcohol under conditions where the monohydric alcohol is in the supercritical state to obtain a reaction mixture;

(g) a separation means for separating the reaction mixture obtained in the reactor (b) to a light liquid containing the fatty acid esters and a heavy liquid containing glycerol;

(h) a separation means for removing the monohydric alcohol from the light liquid obtained with the separation means (g) to obtain an alcohol-free light liquid;

(i) a separation means for removing the fatty acid esters from the alcohol-free light liquid obtained with the separation means (h) to obtain an unreacted material liquid containing the unreacted reactants and/or intermediate products; and

(j) a means for supplying the unreacted material liquid obtained with the separation means (i) to the reactor (b).